PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Taishi TSUJI, et al.

Appln. No.: 10/509,390

Confirmation No.: 5831

Filed: June 28, 2005

Docket No: Q83773

Group Art Unit: 1794

Examiner: Michael E. Nelson

For: ORGANIC ELECTROLUMINESCENCE ELEMENT

SUBMISSION OF EXECUTED DECLARATION UNDER 37 C.F.R. §1.132

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Submitted herewith is a copy of an executed Declaration Under 37 C.F.R. §1.132 signed by Taishi TSUJI.

Respectfully submitted,

/Sunhee lee/

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WASHINGTON OFFICE
23373
CUSTOMER NUMBER

Date: July 22, 2008

IN THE UNITED STATES

PATENT AND TRADEMARK OFFICE

In re patent Application of: Taishi TSUJI, et al.

Serial Number : 10/509,390

Filed : September 27, 2004

For : ORGANIC ELECTROLUMINESCENCE DEVICE

Examiner : Michael E. Nelson

Group Art Unit : 1794

The Honorable Commissioner of Patents and Trademarks

Washington, D.C. 20231

DECLARATION UNDER 37 C.F.R. 1.132

Sir:

I, Taishi TSUJI, declare and state:

That I am a citizen of Japan residing at 6-1-2, Fujimi, Tsurugashima-shi, Saitama 350-2288, Japan:

That I graduated from Graduate School of Engineering of Tokyo Institute of Technology, the Department of Organic and Polymeric Materials, Master Course, in March, 1991 and immediately thereafter I entered in the employ of PIONEER CORPORATION, assignee of the above-identified patent application, and I have been engaged in research and developments relating to the field of materials for electronic and optical devices and, at present, I am studying organic electroluminescence (EL) devices at the Corporate

Research and development Laboratory of PIONEER CORPORATION:

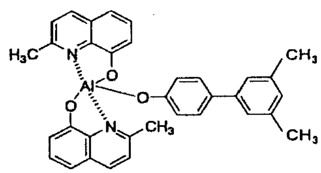
That I am the joint inventor of the above-identified patent application and am familiar with the subject matter disclosed in said application: and

That I conducted comparative experiments to observe the emitting characteristics of the EL devices according to the subject invention in comparison with those of the conventional EL devices, on purpose to find out the unexpected superiority of the present invention, as follows:

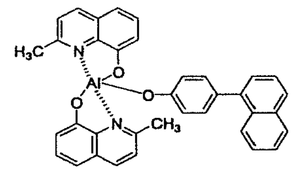
Experimentation:

(1) An organic EL device defined in Claim 1 of the above-identified application (Example 1 described on pages 45-48 thereof) was compared with an organic EL device comprising a light emitting layer including the most similar host material of bis(2-methyl-8-quinolinolato)(2-naphtholato)aluminum (III) represented by PC-18 shown in column 15 of Van Slyke et al. (hereinafter Van Slyke) of U.S. Patent Number 5,150,006.

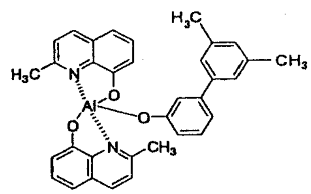
Further I compared the Claim 1 organic EL device additionally with resembling EL devices using close aluminum chelates induced from Van Slyke's PC-6 and PC-7 shown in column 13, i.e., bis(2-methyl-8-quinolinolato)(m-phenylphenolato)aluminum (III) and bis(2-methyl-8-quinolinolato)(p-phenylphenolato) aluminum (III). The close aluminum chelates induced from Van Slyke's PC-6 and PC-7, the aluminum chelate (1) defined in Claim 1, and Van Slyke's PC-18 aluminum chelate are called with TS-No. in this paper as seen from the following list.



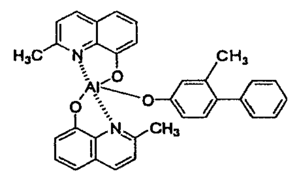
PC-7 ~ TS-320



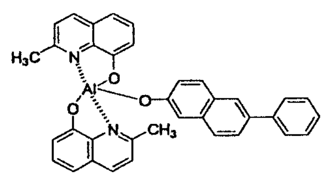
PC-7 ~ TS-321



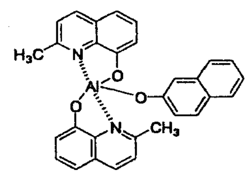
PC-6 ~ TS-328



PC-7 ~ TS-335



Claim 1 = TS-343



PC-18 = TS-265

(2) An organic EL device having a 2mm square size claimed in Claim 1 was manufactured as follows: The transparent anode electrode made of indium tin oxide (ITO) was firstly deposited and formed on a glass plate at 1100 angstroms thick by a sputtering method. The hole injection layer of copper phthalocynanine (CuPc) was secondly deposited and formed on the transparent anode at 250 angstroms thick by a vapor deposition method. The organic hole transport layer of 4,4-bis(N-(naphthyl)-N-phenyl-amino) biphenyl (NPB) was thirdly deposited and formed on the hole injection layer at 550 angstroms thick by a vapor deposition method. The light emitting layer consisting of an organic host material of TS-343 (aluminum chelate (1) defined in Claim 1) and an organic guest material, bis(2-(2'-benzo[4,5-a]thienyl) pyridinato-N,C3')iridium acetyl-acetonate (Red-P) emitting red phosphorous was fourthly co-deposited from respective vapor

deposition sources at 475 angstroms thick on the hole transport layer. In this step, the concentration of the organic guest material Red-P in the light emitting layer was 7 wt%. The electron transport layer of tris(8-hydroxyquinoline) aluminum (Alq3) was fifthly deposited and formed on the light emitting layer at 300 angstroms thick by a vapor deposition method. The electron injection layer of lithium fluoride (LiF) was sixthly deposited and formed on the electron transport layer at 10 angstroms thick by a vapor deposition method. The cathode of aluminum (Al) was seventhly deposited and formed on the electron injection layer at 1000 angstroms thick by a vapor deposition method. Finally the device stack was sealed on the glass plate except lead conductors for the anode and cathode.

In this way, the organic EL device of Claim 1 was manufactured in which the light emitting layer includes TS-343 as a host material.

(3) Next, the comparative organic EL devices were manufactured in substantially the same manner as the EL device of Claim 1 mentioned above with the exception of using TS-265 (PC-18), TS-320 (PC-7 like), TS-321 (PC-7 like), TS-328 (PC-6 like), and TS-335 (PC-7 like) as host materials in the light emitting layers respectively instead of TS-343.

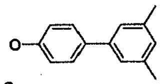
(4) All EL devices were driven under a constant current of 5.5 mA/cm^2 condition while the intensity changes of luminance of all EL devices were measured for 1000 hours or more at ambient temperature. Measured results of EL intensity, driving voltage and initial luminance of all EL devices are ploted as follows:

Device structure:

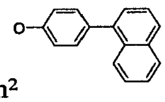
ITO(1100 Å)／CuPC(250 Å)／NPB(550 Å)／Host + Red-P(475 Å)／Alq3(300 Å)／LiF(10 Å)／Al(1000 Å)

Host material list:

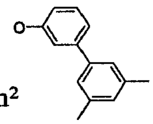
—▽— TS-320 : ligand
Initial
luminance = 329cd/m²



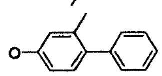
—×— TS-321 : ligand
Initial
luminance = 299cd/m²



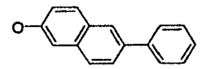
—+— TS-328 : ligand
Initial
luminance = 326cd/m²



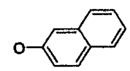
—△— TS-335 : ligand
Initial
luminance = 307cd/m²

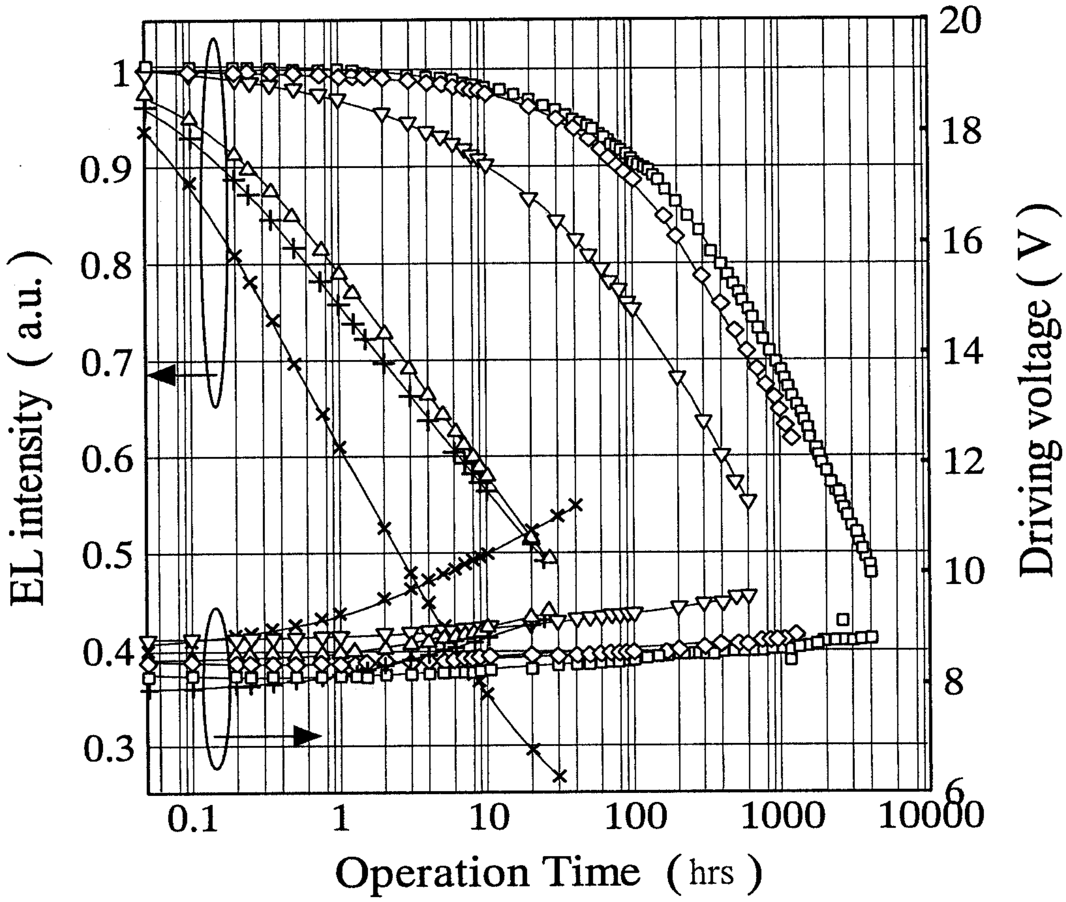


—□— TS-343 : ligand
Initial
luminance = 354 cd/m²



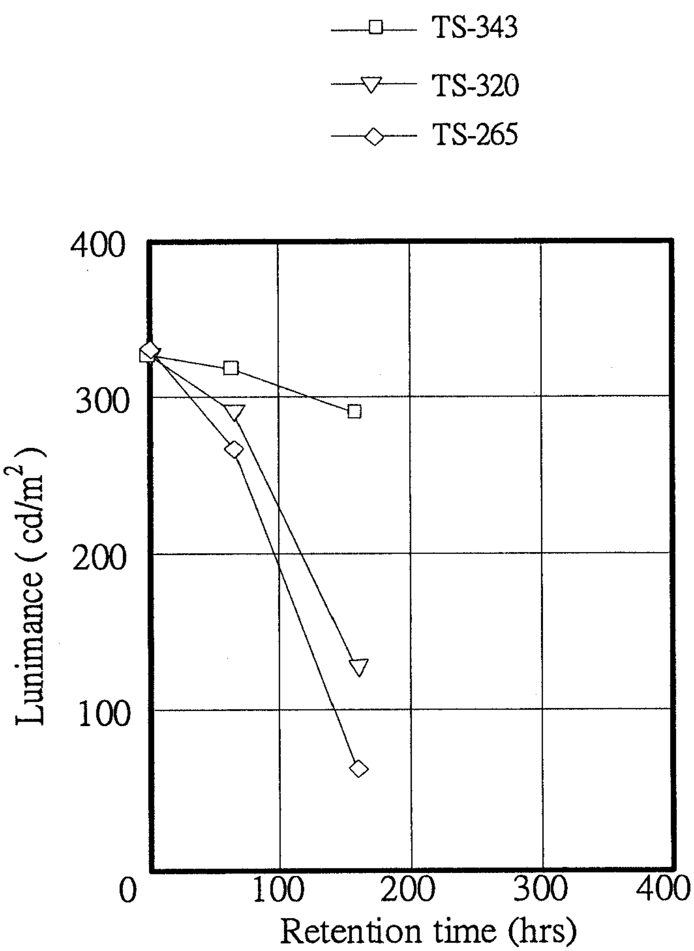
—◇— TS-265 : ligand
Initial
luminance = 338cd/m²





The EL devices of Claim 1 (TS-343), TS-265 (PC-18), and TS-320 (PC-7 like) are better in the half-life of EL intensity than those of TS-321 (PC-7 like), TS-328 (PC-6 like), and TS-335 (PC-7 like).

(5) Furthermore the EL devices of Claim 1 (TS-343), TS-265 (PC-18), and TS-320 (PC-7 like) were driven under a constant current of 5.5 mA/cm^2 condition while the EL devices' luminance were measured for about 400 hours under a temperature 100° C as a storage test. The following graph shows a luminance - Retention time characteristics resulted from the 100° C storage test.



Conclusion:

From the above results, it can be observed that when the organic El device of the example was stored under the circumstance at 100° C, the luminance of TS-265 (PC-18) and TS-320 (PC-7 like) devices were lowered by 50% or lower relative to the initial value about 330 cd/m^2 at lapse of 159 hrs.

On the contrary, for the lowering of the luminance of the EL devices of Claim 1 (TS-343), the luminance was lowered by 80% relative to the initial value at lapse of 159 hrs at 100° C.

It is considered that the physical and electrical characteristics of the EL devices of Claim 1 (TS-343) was stable, and its degradation of luminance during continuous driving was suppressed and the driving life was improved in comparison with the devices of the TS-265 (PC-18) and TS-320 (PC-7 like).

The organic EL device using the organic host material shown by the structural material (1), (TS-343), in the light emitting layer had a more preferred current-luminance and durability characteristics than those of the other devices using the other BAlq-type materials in the light emitting layer host material, and suffered from less lowering of efficiency, particularly, in a higher luminance region exceeding 300 cd/m^2.

From the foregoing, I conclude that the EL device according to the subject invention has an unexpected superiority and inventive step over the conventional EL device disclosed by Van Slyke.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the above-identified application or any patent issued thereon.

Signature: Taishi Tsuji

Taishi TSUJI

Date: June, 25 2008